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History Sheet

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Contents

Figures

Acronyms and Abbreviations

Reference the piping and instrumentation diagrams (P&IDs) symbols and legend sheets, as listed in section 2, for acronyms and abbreviations employed on the attached figures.

CNP	cesium nitric acid recovery process
Cs	cesium
DOE	US Department of Energy
FEP	waste feed evaporation process
FRP	waste feed receipt process
HLP	HLW lag storage and feed blending process
HLW	high-level waste
LAH	level alarm high
LI	level indication
LOL	lower operating limit
LSH	level switch high
LT	level transmitter
P&ID	piping and instrumentation diagram
PT	pretreatment
Sr	strontium
Tc	technetium
TFC	tank farm contractor
TRU	transuranic
UFP	ultrafiltration process
UOL	upper operating limit
WTP	Hanford Tank Waste Treatment and Immobilization Plant

Glossary

acquire	Acquire is a command under a batch control that reserves a group of equipment for that particular batch control operation.
actual volume	Actual volume is the amount, in US gallons, of waste or process fluid in any vessel.
available space	Available space refers to the volume, in US gallons, of waste or process fluid that any vessel can accommodate and remain below the upper operating limits (UOLs). Available space can be calculated as follows: Available Space = UOL – Actual Volume.
available volume	Available volume refers to the volume, in US gallons, of waste or process fluid that any vessel can transfer to another vessel and remain above the lower operating limit (LOL). Available volume can be calculated as follows: Available Volume = Actual Volume – LOL.
batch	This refers to material that is being produced or that has been produced by a single execution of a batch process.
batch control	This term refers to control activities and control functions that provide an ordered set of processing activities to complete a batch process.
control system	This term refers to electronic processors that perform regulatory and logic control functions necessary for normal operation of the plant.
exception handling	This term refers to those functions that deal with plant or process contingencies and other events that occur outside the normal or desired behavior of batch control.
intermediate products	These are treated high-level waste (HLW) products that are staged and blended in the pretreatment (PT) facility prior to immobilization in the HLW vitrification facility. These products include treated solids slurry, Sr/TRU precipitate slurry, and cesium concentrates.
LOL	Lower operating limit refers to a vessel low level set point used to stop a transfer-out batch operation from the vessel under normal plant operations.
permissive	A permissive is an interlock that allows a device to change state or a sequence to start. Once a device has changed state or a sequence has started, a permissive has no further effect on the device or sequence.
release	Release is a command under a batch control that opens up a group of equipment for any batch control to acquire.
requested volume	The requested volume is the volume, in US gallons, of waste or process fluid that can be delivered to the destination vessel and the total volume will remain below the vessel's upper operating limit.
Sr/TRU precipitate	For Envelope C feed, the strontium and transuranic elements are precipitated out of solution and separated from the supernate along with any entrained solids to produce the slurry.

trip	A trip is an interlock that does not allow a device to change state or a sequence to start. Once a device has changed state or a sequence has started, a trip continues to have an effect on the device or sequence.
UOL	Upper operating limit refers to a vessel high level setpoint used to stop a transfer-in batch operation to that vessel under normal plant operations.

1 Introduction

This document describes the control logic associated with vessel instrumentation and other ancillary equipment, such as pumps and valves, within the ultrafiltration process (UFP) system in the pretreatment (PT) facility that function to prevent inadvertent overflows within this system through the control system.

2 Applicable Documents

24590-WTP-M6-50-P0001, *P&ID Symbols and Legend Sheet 1 of 6.*

24590-WTP-M6-50-P0002, *P&ID Symbols and Legend Sheet 2 of 6.*

24590-WTP-M6-50-P0003, *P&ID Symbols and Legend Sheet 3 of 6.*

24590-WTP-M6-50-P0004, *P&ID Symbols and Legend Sheet 4 of 6.*

24590-WTP-M6-50-P0005, *P&ID Symbols and Legend Sheet 5 of 6.*

24590-WTP-M6-50-P0006, *P&ID Symbols and Legend Sheet 6 of 6.*

24590-PTF-M6-UFP-P0001, *P&ID-PTF Ultrafiltration Feed Preparation System Vessels UFP-VSL-00001A/B (Q).*

24590-PTF-M6-UFP-P0002, *P&ID-PTF Ultrafiltration System Vessel UFP-VSL-00002A (Q).*

24590-PTF-M6-UFP-P0003, *P&ID-PTF Ultrafiltration System Vessel UFP-VSL-00002B (Q).*

24590-PTF-M6-UFP-P0004, *P&ID-PTF Ultrafiltration Permeate Collection System Vessels UFP-VSL-00062A/B/C (Q).*

24590-PTF-M6-UFP-P0005 *P&ID-PTF Ultrafiltration Utility Services - PSA Rack (Q).*

24590-PTF-M6-UFP-P0006 *P&ID-PTF Ultrafiltration Utility Services - PSA Rack (Q).*

24590-PTF-M6-UFP-P0007 *P&ID-PTF Ultrafiltration Utility Services - PSA Rack (Q).*

24590-PTF-M6-UFP-P0008 *P&ID-PTF Ultrafiltration Utility Services - PSA Rack (Q).*

24590-PTF-M6-UFP-P0009 *P&ID-PTF Ultrafiltration Utility Services - PSA Rack (Q).*

24590-PTF-M6-UFP-P0010 *P&ID-PTF Ultrafiltration Utility Services - PSA Rack (Q).*

24590-PTF-M6-UFP-P0011 *P&ID- PTF Ultrafiltration Utility Services - PSA Rack (Q).*

24590-PTF-M6-UFP-P0015, *P&ID-PTF Ultrafiltration Utility Services – Plant Wash Rack (Q).*

24590-PTF-M6-UFP-P0016, *P&ID-PTF Ultrafiltration Reagent & Process Air Bulge (Q).*

24590-PTF-M6-UFP-P0017, *P&ID-PTF Ultrafiltration Reagent & Process Air Bulge (Q).*

3 Description

The following sections describe the seven major vessels that make up the ultrafiltration system and the associated instrumentation.

3.1 Ultrafiltration Feed Preparation Vessel , UFP-VSL-00001A

Vessel UFP-VSL-00001A is one of two feed preparation vessels. During normal operations, this vessel may receive feed from the high-level waste (HLW) lag storage and feed blending process (HLP) system, the waste feed receipt process (FRP) system, and/or the waste feed evaporation process (FEP) system. A specific volume will be requested by the ultrafiltration feed preparation vessel (UFP-VSL-00001A) from each of these systems. The volumes requested will also account for additional space to receive process condensate for dilution and precipitation reagents as required (Envelope C) , and still be within the upper operating limit (UOL) of the vessel. Once blended, these feeds are transferred out to the ultrafiltration feed vessels (UFP-VSL-00002A or UFP-VSL-00002B).

For better control of any transfer operation for the ultrafiltration feed preparation vessel (UFP-VSL-00001A), transfers are limited by the batch control operation to one transfer in or out at a time. Once the batch control performs the "acquire" step involving the ultrafiltration feed preparation vessel (UFP-VSL-00001A); no other batch control operation is able to acquire the vessel until the vessel is released from the initial operation. The steps involving acquiring and releasing ensure that this vessel cannot transfer in or out from multiple destinations at the same time.

When the vessel is available to receive feed, the operator will initiate the transfer-in sequence. Once the sequence is initiated, the control system will verify that all instruments, utilities, and equipment associated with the transfer are within operational parameters. If any of the parameters are not within the specified limits during the transfer, the control system will switch to an exception handling function. Under normal operating conditions the sequence will be stopped if any of the following occurs:

- The specified volume is transferred.
- The level in the ultrafiltration feed preparation vessel (UFP-VSL-00001A) reaches its UOL.
- The source vessel reaches its lower operating level (LOL).

Once the vessel has been filled, cooled (if required), and sampling is completed as required, the control system will notify the operator that the ultrafiltration feed preparation vessel (UFP-VSL-00001A) is ready to transfer out. The transfer-out sequence can then be initiated by the receiving system. Once initiated, the control system verifies that all instruments, utilities, and equipment associated with the transfer are within operational parameters. If any of the parameters are not within the specified limits during the transfer, the control system will switch to an exception handling function. Under normal operating conditions the sequence will be stopped if any of the following occurs:

- The level in the ultrafiltration feed preparation vessel (UFP-VSL-00001A) reaches its LOL.
- A specified volume is transferred.
- The destination vessel reaches its UOL.

During the entire transfer-in or transfer-out sequence, the control system constantly monitors the sump alarms within the PT facility and notifies the operator if an alarm condition occurs. The operator can then decide whether to manually stop the transfer. The position switches of valves are also constantly monitored by the control system. If any of the associated valves are in the wrong position the batch control will switch to an exception handling function.

All of the above controls will prevent an overflow in the ultrafiltration feed preparation vessel UFP-VSL-00001A.

Refer to Figure 1 for level measurement details for the ultrafiltration feed preparation vessel UFP-VSL-00001A.

3.2 Ultrafiltration Feed Preparation Vessel, UFP-VSL-00001B

Ultrafiltration feed preparation vessel (UFP-VSL-00001B) performs the same functions as the ultrafiltration feed preparation vessel (UFP-VSL-00001A) mentioned above. The batch controls, however, will be programmed such that vessels UFP-VSL-00001A and UFP-VSL-00001B will operate on alternate modes, with one vessel receiving feed (transferring in) while the other vessel is feeding the ultrafilter loops (transferring out).

The batch controls for the ultrafiltration feed preparation vessel (UFP-VSL-00001B) are identical to those for ultrafiltration feed preparation vessel (UFP-VSL-00001A).

Refer to Figure 2 for level measurement details for the ultrafiltration feed preparation vessel (UFP-VSL-00001B).

3.3 Ultrafiltration Feed Vessel, UFP-VSL-00002A

Vessel UFP-VSL-00002A is one of two ultrafiltration feed vessels. It receives feed from one of the ultrafiltration feed preparation vessels (UFP-VSL-00001A or UFP-VSL-00001B). The feed is concentrated to 20 wt % solids in this vessel by continuously recirculating the feed through a series of ultrafilters. The liquid fraction (permeate) is transferred to one of the three permeate collection vessels (UFP-VSL-00062A, UFP-VSL-00062B, or UFP-VSL-00062C). To account for the volume loss in the vessel due to liquid fraction (permeate) being transferred out, fresh feed is constantly added from one of the ultrafiltration feed preparation vessels (UFP-VSL-00001A or UFP-VSL-00001B). Upon reaching 20 wt % solids (15 wt % for Envelope C), the concentrated solids are washed, leached (if required) and post washed before being transferred to one of the HLW lag storage vessels (HLP-VSL-00027A or HLP-VSL-00027B). There is also the capability to transfer the solids directly to the HLW blend vessel (HLP-VSL-00028). If the concentrated solids meet the requirement of low-activity waste (LAW) feed, these solids can then be transferred to the LAW concentrate buffer vessel (TCP-VSL-00001). If further concentration of solids is required, a transfer to the evaporator feed vessel (FEP-VSL-00017B) is also possible.

For better control of any transfer operation involving the ultrafiltration feed vessel (UFP-VSL-00002A), transfers are limited by the batch control operation to one transfer in or out at a time. Once the batch control performs the "acquire" step involving the ultrafiltration feed vessel (UFP-VSL-00002A), no other batch control operation is able to acquire the vessel until the vessel is released from the initial operation. The steps involving acquiring and releasing ensure that this vessel cannot transfer in or out from multiple destinations at the same time.

When the vessel is available to receive feed, the operator will initiate the transfer-in sequence. Once the sequence is initiated, the control system will verify that all instruments, utilities, and equipment associated with the transfer are within operational parameters. If any of the parameters are not within the specified limits during the transfer, the control system will switch to an exception handling function. Under normal operating conditions the sequence will be stopped if any of the following occurs:

- The level in the ultrafiltration feed vessel (UFP-VSL-00002A) reaches its UOL.
- A specified volume is transferred.
- The source vessel reaches its LOL.

At this point the ultrafiltration sequence can be initiated. Once initiated, the concentration to 20 wt % and the separation of liquid fraction (permeate) from the solids fractions begins. The permeate will be collected in one of the three permeate collection vessels (UFP-VSL-00062A, UFP-VSL-00062B, or UFP-VSL-00062C). During this sequence, the control system will verify that all instruments, utilities, and equipment associated with the transfer are within operational parameters. If any of the parameters are not within the specified limits during the transfer, the control system will switch to an exception handling function.

Once the concentration to 20 wt % is complete, the solids are washed and leached (if required). The control system will then notify the operator that vessel UFP-VSL-00002A is ready for sampling and transfer-out. Once the transfer-out sequence is initiated, the control system verifies that all instruments, utilities, and equipment associated with the transfer are within operational parameters. If any of the parameters are not within the specified limits during the transfer, the control system will switch to an exception handling function. Under normal operating conditions the sequence will be stopped if any of the following occurs:

- The level in the ultrafiltration feed vessel (UFP-VSL-00002A) reaches its LOL.
- A specified volume is transferred.
- The destination vessel reaches its UOL.

During the entire transfer-in or transfer-out sequence, the control system constantly monitors the sump alarms within the PT facility and notifies the operator if an alarm condition occurs. The operator can then decide whether to manually stop the transfer. The position switches of valves are also constantly monitored by the control system. If any of the associated valves are in the wrong position the batch control will switch to an exception handling logic.

All of the above controls will prevent an overflow in ultrafiltration feed vessel UFP-VSL-00002A.

Refer to Figure 3 for level measurement details for the ultrafiltration feed vessel UFP-VSL-00002A.

3.4 Ultrafiltration Feed Vessel, UFP-VSL-00002B

Vessel UFP-VSL-00002B performs the same functions as vessel UFP-VSL-00002A mentioned above. The batch controls, however, will be programmed such that vessels UFP-VSL-00002A and UFP-VSL-00002B will operate on alternate modes, with one vessel in the ultrafiltration cycle (concentrating) while

the other vessel is in solids treatment. Solids treatment consists of solids washing and solids leaching (if required) and post washing. There is also the cleaning cycle for ultrafilters that will not pose an overflow condition, and hence is not covered in this document.

The batch controls for the ultrafiltration feed vessel UFP-VSL-00002B are identical to those for ultrafiltration feed vessel UFP-VSL-00002A.

Refer to Figure 4 for level measurement details for ultrafiltration feed vessel UFP-VSL-00002B.

3.5 Permeate Collection Vessel, UFP-VSL-00062A

Vessel UFP-VSL-00062A is one of three permeate collection vessels that can be used for collecting the permeate (liquid fraction) during the ultrafiltration concentration cycle or for collecting the wash permeate during the solids treatment (washing, leaching), from the ultrafiltration feed vessels (UFP-VSL-00002A or vessel UFP-VSL-00002B). If the vessel is used to receive permeate, the collected permeate is sampled, then transferred out to the cesium ion exchange process (CXP) system for further processing. Off-specification permeate (excessive turbidity) is transferred back to one of the ultrafiltration feed preparation vessels (UFP-VSL-00001A or UFP-VSL-00001B). If the vessel is used to receive wash permeate, the collected wash permeate is transferred out to one of the acidic/alkaline effluent collection vessels (PWD-VSL-00015 or PWD-VSL-00016). The above functions are interchangeable between the three vessels and depend on the function assigned by the operator at that time.

The transfer-in sequence into this vessel is part of the ultrafiltration batch control operation being performed for one of the ultrafiltration feed vessels (UFP-VSL-00002A or UFP-VSL-00002B). Under normal operating conditions this sequence will switch to another permeate vessel when the level in permeate collection vessel UFP-VSL-00062A reaches its UOL.

When the UOL has been reached and sampling is completed as required, the control system will notify the operator that the permeate collection vessel UFP-VSL-00062A is ready to transfer out. The transfer-out sequence can then be initiated by the receiving system. Once initiated, the control system verifies that all instruments, utilities, and equipment associated with the transfer are within operational parameters. If any of the parameters are not within the specified limits during the transfer, the control system will switch to an exception handling function. Under normal operating conditions the sequence will be stopped if any of the following occurs:

- The level in the permeate collection vessel (UFP-VSL-00062A) reaches its LOL.
- A specified volume is transferred.
- The destination vessel reaches its UOL.

During the entire transfer-in or transfer-out sequence, the control system constantly monitors the sump alarms within the PT facility and notifies the operator if an alarm condition occurs. The operator can then decide whether to manually stop the transfer. The position switches of valves are also constantly monitored by the control system. If any of the associated valves are in the wrong position, the batch control will switch to an exception handling function.

Refer to Figure 5 for level measurement details for the permeate collection vessel UFP-VSL-00062A.

3.6 Permeate Collection Vessel, UFP-VSL-00062B

Vessel UFP-VSL-00062B performs the same functions as vessel UFP-VSL-00062A mentioned above. The batch controls for permeate collection vessel UFP-VSL-00062B are identical to those for permeate collection vessel UFP-VSL-00062A.

Refer to Figure 6 for level measurement details for the permeate collection vessel UFP-VSL-00062B.

3.7 Permeate Collection Vessel, UFP-VSL-00062C

Vessel UFP-VSL-00062C performs the same functions as permeate collection vessel UFP-VSL-00062A and permeate collection vessel UFP-VSL-00062B mentioned above. The batch controls for permeate collection vessel UFP-VSL-00062C are identical to those for permeate collection vessels UFP-VSL-00062A and UFP-VSL-00062B.

Refer to Figure 7 for level measurement details for the permeate collection vessel UFP-VSL-00062C.

Figure 1. Level Measurement for Ultrafiltration Feed Preparation Vessel (UFP-VSL-00001A)

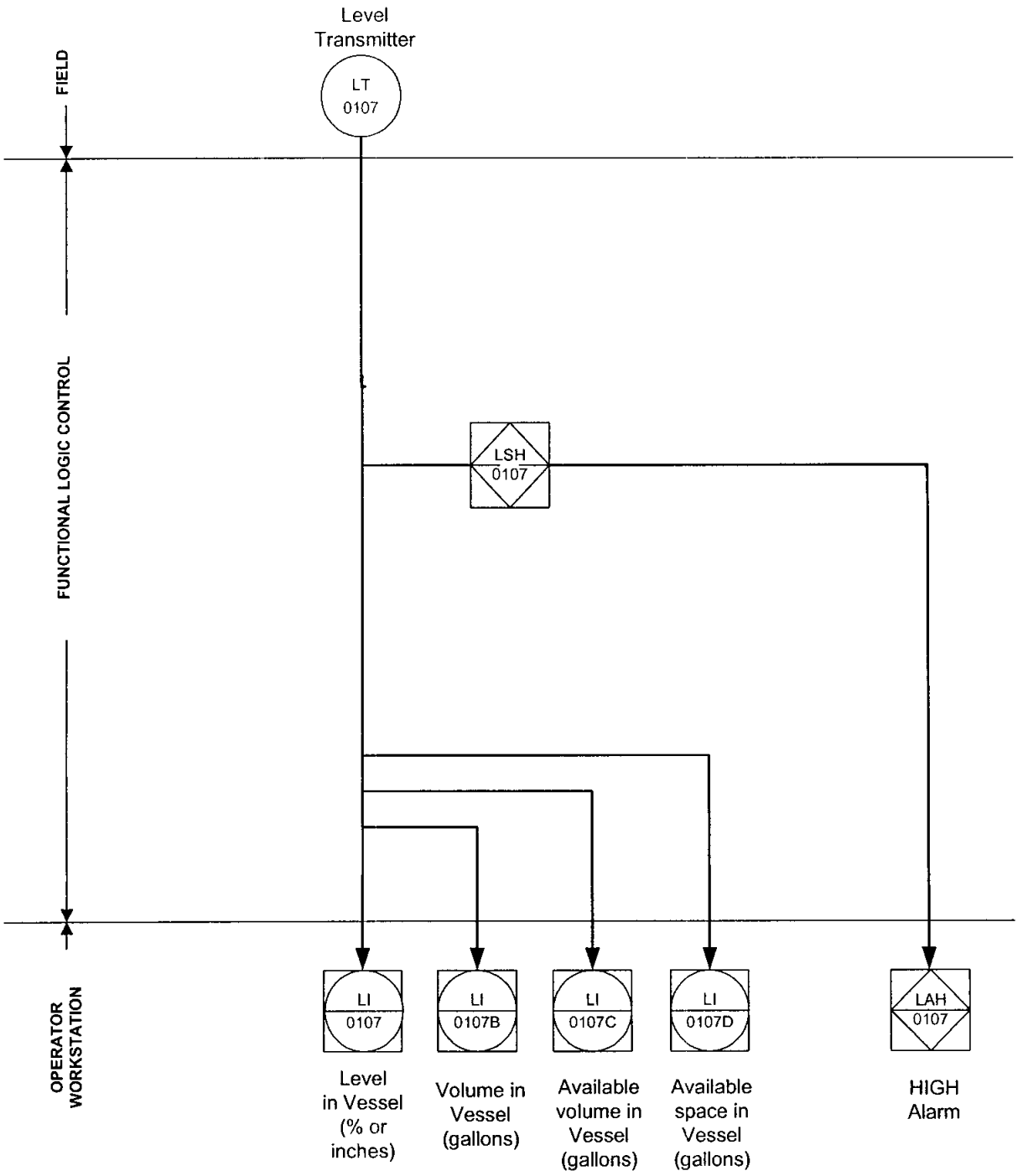

Figure 2. Level Measurement for Ultrafiltration Feed Preparation Vessel (UFP-VSL-00001B)

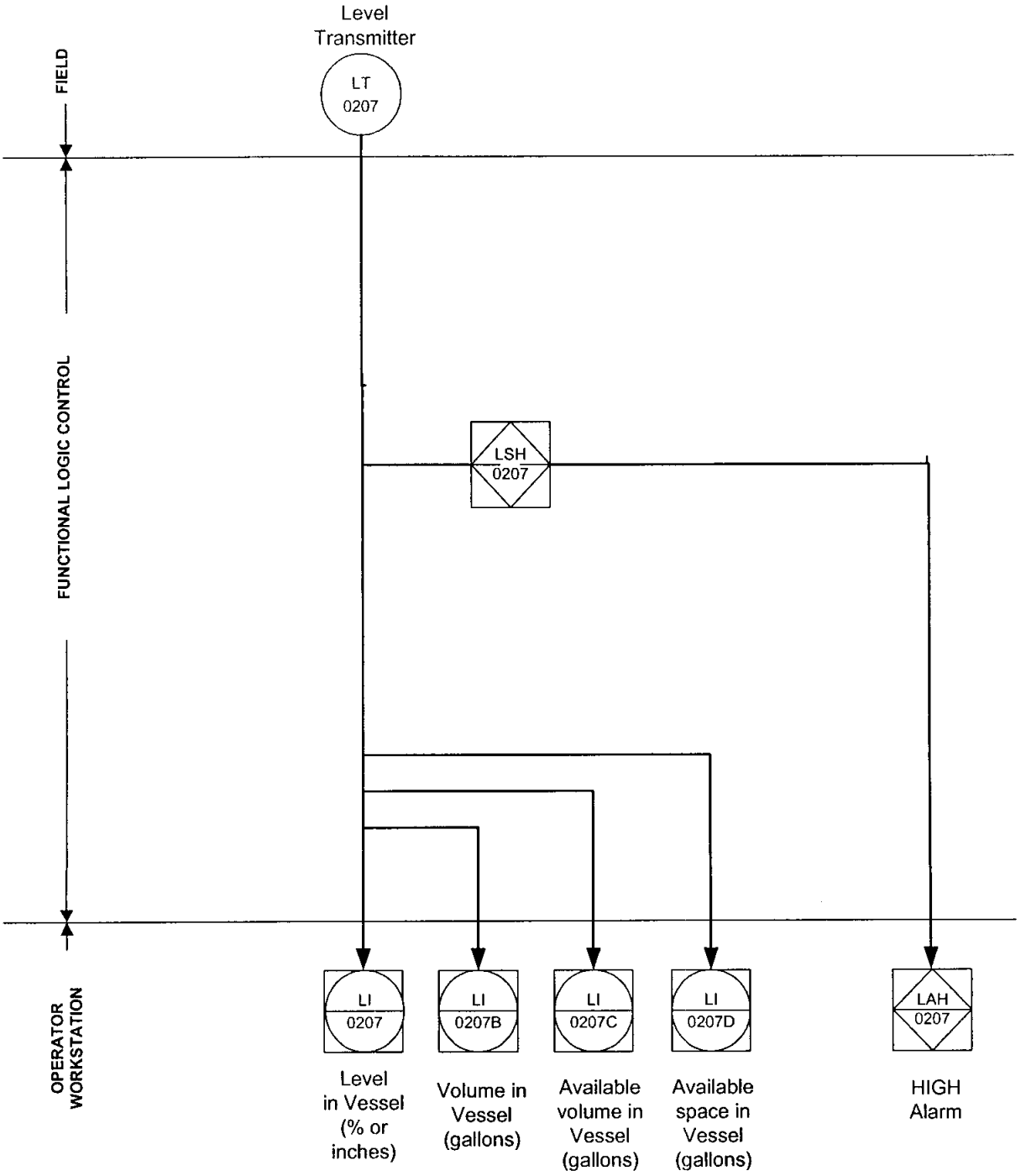

Figure 3. Level Measurement for Ultrafiltration Feed Vessel (UFP-VSL-00002A)

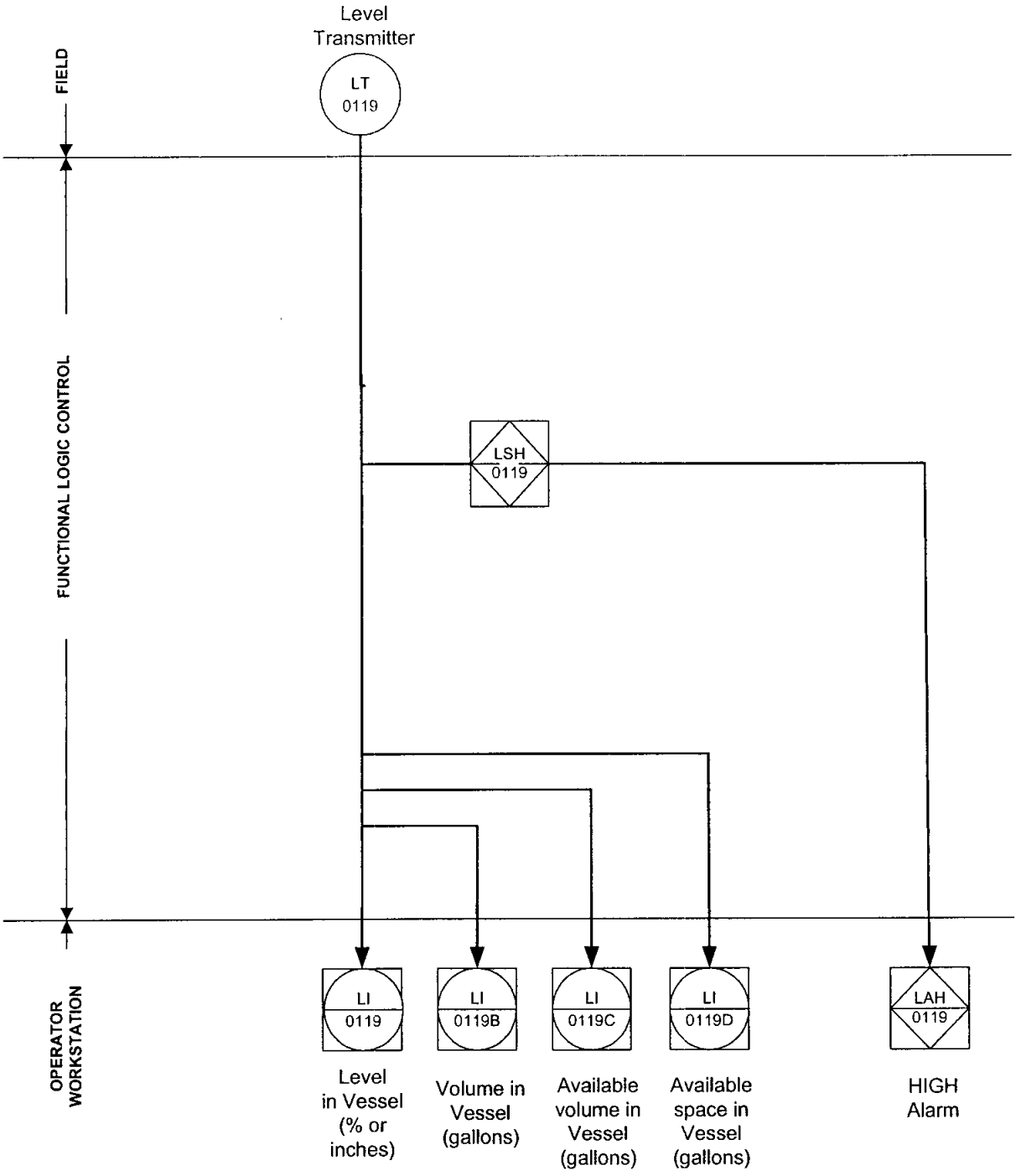

Figure 4. Level Measurement for Ultrafiltration Feed Vessel (UFP-VSL-00002B)

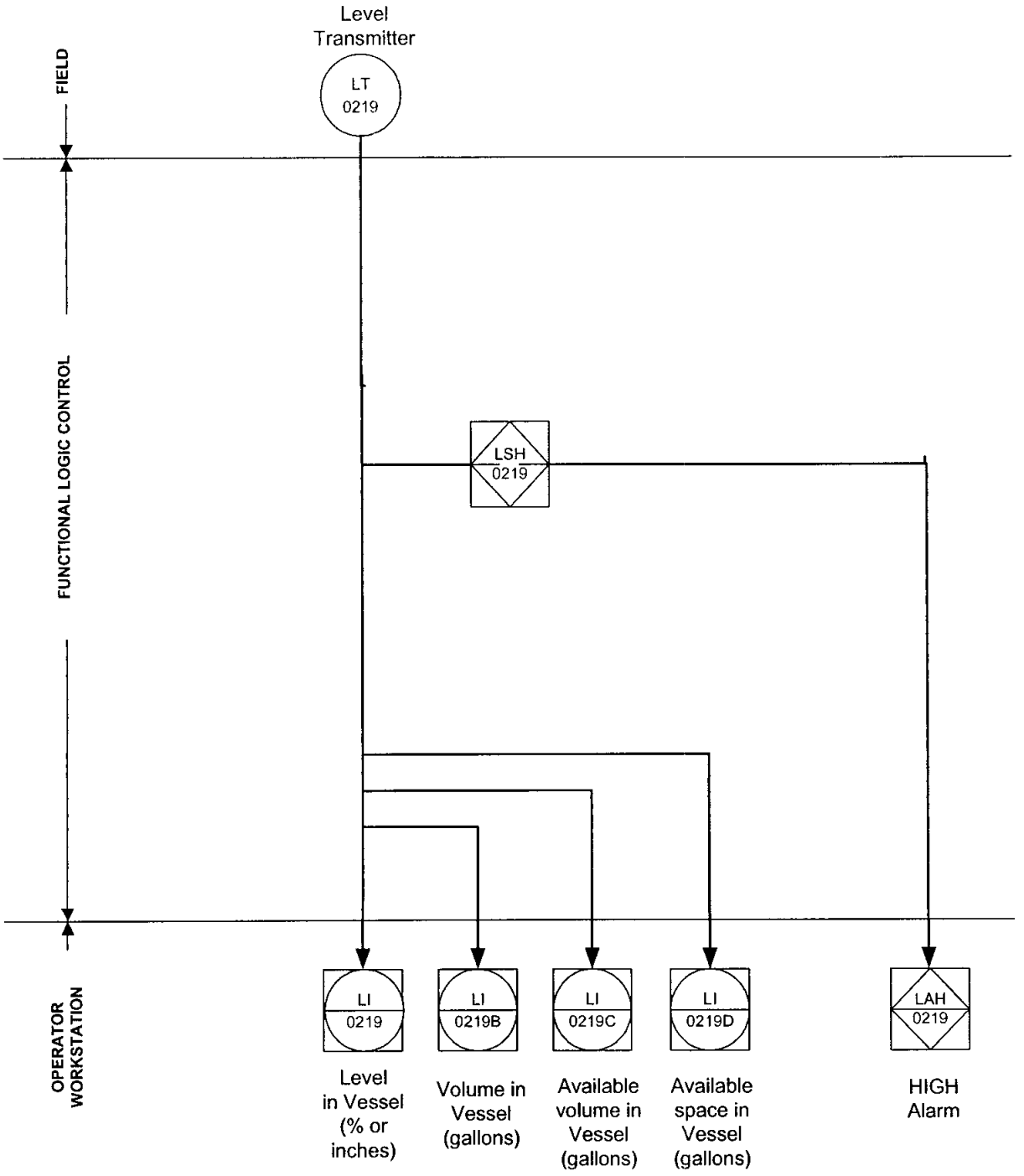

Figure 5. Level Measurement for Permeate Collection Vessel (UFP-VSL-00062A)

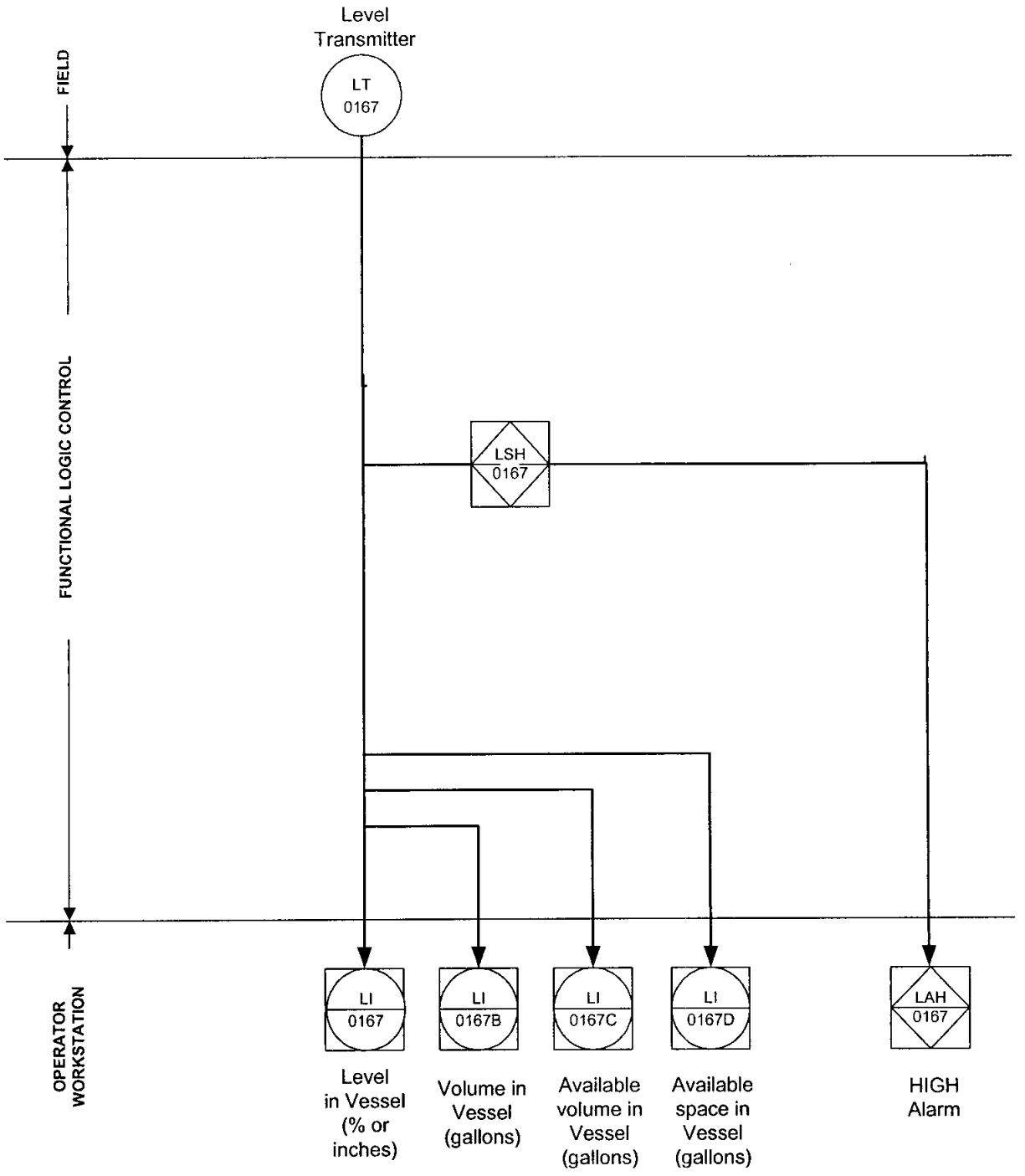

Figure 6. Level Measurement for Permeate Collection Vessel (UFP-VSL-00062B)

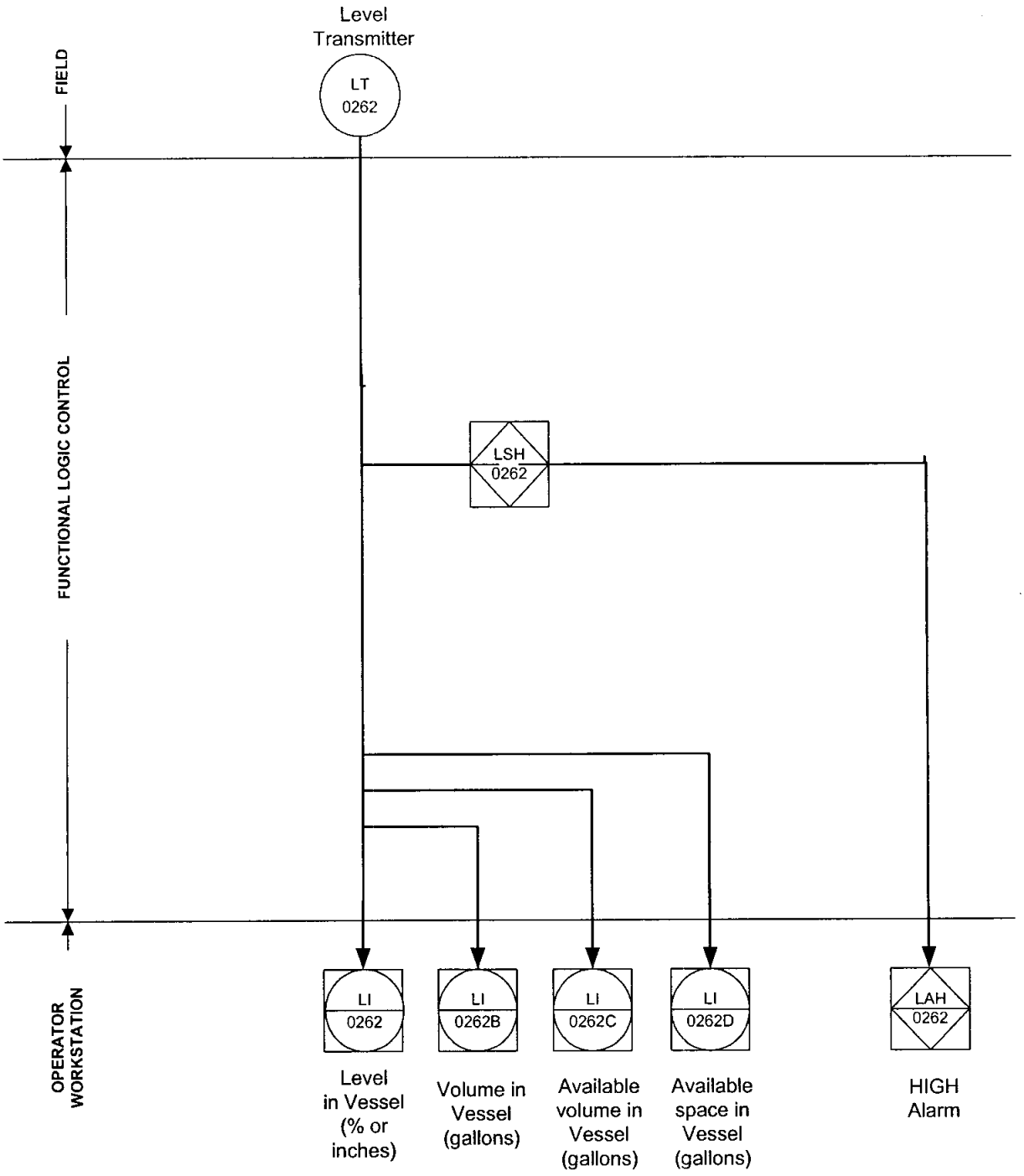

Figure 7. Level Measurement for Permeate Collection Vessel (UFP-VSL-00062C)